



MUSIC THERAPY: HOW MUSIC INFLUENCES HUMAN RESPONSES

Ihirwe Keza Marie Pascale

Impact & Research Fellowship Program, Harvard Student Agencies, In collaboration with Learn with Leaders

ABSTRACT

This paper aims to study the influence of Music on human responses through the brain and its use to heal diseases in a therapy known as music therapy. Music therapy is an evidence-based practice that has been used to treat a variety of physical and mental health conditions. It involves using music, sound, and rhythm to promote healing in individuals. Over 1.6 million people are served per year, and most people primarily benefit from it. For instance, music therapy can improve the overall quality of life in Parkinson's disease patients by 54%, and music therapy has been shown to reduce heart rate by an average of 6 beats per minute in preterm infants.

KEYWORDS: Music, Therapy, Perception, Gestalt Laws, Motor Functions, Tension, Relaxation, Healing

1. INTRODUCTION

Today, most people turn to music when facing their highs and lows because music gives people pleasure by acting on the brain's opioid system. Music dramatically impacts our lives, whether directly or indirectly, intentionally, or unintentionally. This research will help to gain more insights into the brain's behavior towards music, how this behavior heals diseases, and why music is so impactful in our lives.

A Brief History of Music

The medieval monks were the first to discover a simple and precise musical script that should have been stripped of technicalities and extravagances. However, its authors placed obstacles in the path, leading to the notation of music being hedged around with unnecessary difficulties. Human became a talker, tasked with joining his intellect with his emotions and rhythm with changes in pitch. The rhythm was too stubborn to be changed, but with their voice, the plan of action needed to be more prominent. It was only after centuries of effort that humans understood the changes required. Instead of an aimless rise and fall in his voice, they had a series of clearly defined steps, cutting out intermediate sounds and allowing themselves to express their emotions in terms of intellect. The rhythm of the notes, the rise and fall, the loudness and softness of their voice remained; they could be made the basis of art. Finally, in this lengthy but simple history, humans had to discover that the same emotional concepts could be expressed through words and music, and when they got so far, they had gone beyond the stage of talking and a song was invented (Stanford & Forsyth, 2022, p. 6).

Methodology

Using tools such as Google Scholar, PubMed, Web of Sciences, Google books, and Science.gov, peer-reviewed literature sources were found using terms like "music" and "music therapy."

Based on how well the articles related to the search parameters, 10 articles were chosen for additional review. This paper will combine various qualitative research that professionals and scientists developed to acquire more knowledge about music and the brain's deportment towards it.

2. Music and the Brain

Our responses as we listen to various songs differ depending on the rhythm and beats that make up that song. Individuals may begin stomping on the ground, dancing, or singing, laughing or crying, and feeling certain emotions such as happiness, sadness, pity, empathy, and many others.

Researchers suggest that people should spend 40% of their waking time listening to music passively or actively. This percentage shows how much of an influence music has on our brains and our daily activities. With the help of fMRI, neurologists have done enormous research to understand the brain function of music. Using a powerful magnetic field, a functional Magnetic Resonance Imaging (fMRI) scanner detects brain activity. When an area of the brain becomes more active, such as when one waves their hand, there is an increase in blood flow to that region.

An fMRI imaging scan takes advantage of activated neurons requiring more oxygen from red blood cells. This increase in activity leads to a change in blood flow. fMRI detects these changes by indirectly measuring the alterations in blood flow and electrical activity, and fMRI assesses brain activity. Using fMRI, researchers can examine a range of cognitive functions, from memory formation to decision-making. Furthermore, fMRIs may be used to investigate the impact of various diseases on brain function. The brain activity is mapped out using a color-coded system using fMRI scans (*fMRI Scans: What Are They & How They Work*, n.d.).

In a study, researchers got participants listening to music to comprehend the brain's behavior towards music, and multiple parts of the brain lit up. However, when they observed the brains of musicians playing instruments, the whole brain lit up (the parts that light up are the ones that are activated). It was found that music and performance affect nearly every part of the brain; music alters mood and feelings by stimulating the formation of specific brain chemicals, for instance, dopamine, which causes a feeling of satisfaction. When listening to our favorite music, we experience the same feeling as eating food, doing drugs or having sex. Music also alters feelings, for example, sadness; when we are sad, we listen to sad music. This raises various questions; for example, *why is this? Why not use happy music to cheer ourselves up?* The reason is that when we are sad, we feel like everyone is against us because they are happy; we want them to feel the same way we are.

Similarly, happy music does the same thing; it makes us feel the same way we feel towards those people. Therefore, we turn to sad music because it makes us feel as if the singer relates to us; we feel relieved and understood, which brightens the mood. Therefore, we feel better.

Other studies show that the brain's right hemisphere is preferentially activated when listening to songs that we find emotional. This site is also affected when we are just imagining the music. Duke University professors experimented on a professional violinist, Jeniffer KOH, to explain the science behind the brain's ability to process music. Koh was asked to envision playing, listening to, or reading the musical scores of a series of classical compositions for solo violin by Paganini and Bach as she lay immobile on her back in the MRI machine, and her brain activity was monitored (Ferreri, 2016).

Tobias Overath, a neuroscientist, then studied how Koh's brain reacted to each. He stated that the data revealed a distinct activation pattern when she was reading, hearing, and visualizing herself playing music. However, a few characteristics were in common: although Koh never raised a finger throughout the three tasks, the brain regions in charge of movement planning were engaged (Ferreri, 2016).

Her brain activity analysis indicated a unique activation pattern for each task, but the researchers also observed common traits. For example, the brain area responsible for planning movement lit up on all three occasions even though Koh did not move, suggesting an increased sensitivity to music for professionals. They display a unique and particularly intense cognitive response, during which their whole body is prepared to respond to music (Surugue, 2016). "The musician's brain is exquisitely sensitive to all aspects of music, be it listening, reading, or imagining playing music," Overath said. "Thus, one initiates a range of areas of their brain - it is a whole-body experience. From a cognitive point of view, but also physically, it is incredibly strenuous" (Ferreri, 2016).

Electroencephalography (EEG) measurements of participants' event-related potentials during music listening reveal synchronized dynamics between different brain regions,

indicating musical large-scale form perception. This coupling of oscillatory neural signals within frequency bands is linked to various perceptual, sensorimotor, and cognitive processes, including Gestalt perception ([Gray & Singer, 1989](#); [Tallon et al., 1995](#); [Keil et al., 1999](#); [Rodriguez et al., 1999](#); [Tallon-Baudry & Bertrand, 1999](#); [Engel et al., 2001](#); [Engel & Singer, 2001](#)), timing and expectation ([Buhusi and Meck, 2005, 2009](#)), attention ([Womelsdorf & Fries, 2007](#); [Fries, 2009](#); [Nikolić et al., 2013](#)), consciousness ([Baars, 2006](#); [Dehaene et al., 2011](#); [Engel & Fries, 2016](#); [Owen & Guta, 2019](#)), motor functions ([Thaut et al., 2015](#)), and music perception ([Bhattacharya et al., 2001](#); [Zanto et al., 2005](#); [Bonetti et al., 2021](#)).

The studies suggest that coupling oscillatory neural signals within frequency bands is linked to cognitive processes like attention, consciousness, and motor functions, underscoring the significance of brain understanding in music perception. The musical form, the highest level of musical structure, is perceived through Gestalt Laws, which group notes, bars, and phrases into a high-level part. The contrast of form parts, such as verse and chorus in a song, sonata form in classical music, or tension build-up and decay in Techno, House, or Electronic Dance Music, characterizes the musical form. Learned knowledge about these structures leads to the build-up of expectation, fulfillment, and modulated attention. Emotionally, this can be expressed in terms of tension and relaxation ([Koelsch, 2014](#); [Lehne and Koelsch, 2015](#)). The transition from potential energy (expectations) into kinetic energy (dancing) ([Kurth, 1931](#)) can be related to the processing of musical form, as neurons in the motor cortex are entrained by neurons from the auditory cortex ([Thaut et al., 2015](#)).

3. MUSIC THERAPY

A Brief History of Music Therapy.

According to musictherapy.org, "Music has been a healing influence since ancient times, with its potential to affect health and behavior. The earliest use of music to heal diseases is seen in the Jewish bible, where David, a skilled musician, used music to cure King Saul's depression (1 Samuel, 16:23).

Music therapy emerged as a profession after World War I and II when a community of musicians played for veterans in hospitals. The patients' positive responses led doctors and nurses to hire musicians. Therefore, it has developed into a healthcare medicine used so far. Scientists have studied and analyzed how music can cure diseases; among them are Geretsegger et al. (2014), Klassen et al., Gerdner & Swanson, Forsblom et al., and Blood & Zatorre. They studied the impact of music on physical and mental processes, and how it aids people in overcoming obstacles that may be frustrating or highly degrading.

What is music therapy?

Music Therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program. (AMTA, 2005). Music therapy is the use of music to heal issues that are either mental, physical, social, emotional, or cognitive. Bruscia (1991) defined music therapy as 'an interpersonal process

in which the therapist uses music and all of its facets to help patients to improve, restore or maintain health' (Maratos et al., 2008).

The psychology of music is understanding how people hear and perceive musical sounds, known as psychoacoustics – one's perception of music. Another essential facet of the psychology of music is understanding the human ear and how the brain is involved in the appreciation and performance of music (Wigram et al., 2002).

How does Music Therapy work?

Five main factors contribute to the effects of music therapy.

- **Modulation of Attention:** Music distracts from negative stimuli such as worry, anxiety, and pain, potentially reducing pressure and discomfort during medical procedures and enhancing patient experience. (Koelsch, 2009).
- **Modulation of Emotion:** Studies have demonstrated that the activity of brain areas responsible for the initiation, creation, maintenance, termination, and modulation of emotions can be controlled by music.
- **Modulation of Cognition:** Music influences cognition as well; music connects to memory functions such as the encoding, storing, and decoding of musical information and experiences.
- **Modulation of Behavior:** Music also modulates behavior. According to Koelsch (2009), music can elicit and condition actions like those involved in walking, speaking, and grasping.
- **Modulation of Communication:** Music, in fact, is a means of communication. Hence, music can influence relationships. According to Geretsegger et al. (2014), music therapy uses musical interaction, particularly musical improvisation, as a non-verbal and preverbal language. It enables verbally capable individuals to access pre-verbal experiences (Geretsegger et al., 2014). Additionally, it enables verbal and nonverbal individuals to interact verbally (Geretsegger et al., 2014). Lastly, it enables all people to communicate in ways that are more emotionally charged and relationship-focused than may be achievable when only using verbal communication (Geretsegger et al., 2014).

Because of music on the brain, it is widely used for medical purposes as music therapy. Among the conditions that Music heals are aphasia.

Aphasia

Aphasia is the loss of the ability to speak or understand a language. While many people with aphasia cannot speak, some can still sing because the brain stores musical memories. The brain primarily processes language on the left side; it uses both sides to process music and store musical memories. So, people whose left hemisphere is damaged might still use the right side of their brain to sing.

During music therapy, these people gain the ability to speak and

comprehend a language through singing therapy. Ultimately, singing therapy is an engaging form of speech therapy that encourages individuals to practice repeatedly singing the words they want to say. The more they practice, the more substantial new neural connections for language functions should become. Over time, sung words may be able to transition into spoken words (Denslow, 2021).

Alzheimer

The most prevalent kind of dementia is Alzheimer's disease; it is a gradual condition that starts with mild memory loss and may develop into a loss of speech and capacity to react to surroundings. The brain regions that regulate language, memory, and thought are affected by Alzheimer's disease; it may majorly impact an individual's capacity to do everyday tasks.

Music is an intermediary for someone with memory issues because it activates a portion of the brain that controls memory (Baird & Samson, 2009). Even those with poor overall memory can remember the lyrics to songs they last heard years ago. This is because music memories are stored in a part of the brain less affected by memory loss. According to studies, a person's memories associated with music are preserved in contrast to other memories from their life. Recognizing spoken song lyrics without singing is considerably more advanced in Alzheimer's patients; if the words are retained, they can match the melody to the lyrics as part of a song. Alzheimer's does not tend to take your musical memories; those are left relatively intact.

4. CONCLUSION

Research is still being conducted to elucidate the brain's behavior towards music. These studies employ various techniques, one of which is using an fMRI scan to measure brain activity. Functional Magnetic Resonance Imaging measures minor fluctuations in blood flow. An fMRI scan can identify these changes because when neurons are active, they need more oxygen from red blood cells, which increases blood flow. Researchers used an fMRI scan to induce patients to read musical notes, visualize playing instruments, and listen to music. The entire brain was illuminated, according to the fMRI scan. It proved that music does have a profound impact on the brain. Another study showed that listening to emotionally charged music causes the brain's right hemisphere to become preferentially active. Furthermore, following the study of the professional violinist Jeniffer KOH, Tobias Overath concluded that the brain region responsible for movement planning was activated, even though Miss KOH never raised her hand. Professionals are more sensitive to music, as evidenced by the fact that their entire body is trained to react to it.

Finally, an additional search was conducted utilizing electroencephalograph readings of individuals' event-related potentials while listening to music. It demonstrated how neurons in the motor cortex are entrained by neurons in the auditory cortex, causing the brain to process musical shapes by converting potential energy (expectation) to kinetic energy (dance). Owing to all this brain's behavior toward music, music as a form of therapy was developed that helps heal mental

diseases through modulation of attention, emotion, cognition, behavior, and communication, as explained in this paper. For instance, music is used to cure Aphasia and Alzheimer's.

Further research should be conducted to precisely comprehend this behavior. For instance, how exactly does music stimulate the brain to form certain chemicals such as dopamine or hormones such as adrenaline?

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